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PRINCIPAL INVESTIGATOR: Wei Qian, Ph.D.

CONTRACTING ORGANIZATION: University of South Florida
Tampa, Florida 33620-7900

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Wei Qian, Ph.D.

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
University of South Florida
Tampa, Florida 33620-7900

E-Mail: qianw@moffitt.usf.edu

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This is the third year (final) year of the training program, and this is also a significant year of our training program. During this year, based on this summer training program's experience and research accomplishment, we created a new training system called "The Cognitively-based Hypermedia System for CAD-Assisted Mammography Interpretation". This training system successfully got funding support for pre-doctoral training program from Susan Komen Breast Cancer Foundation, starting from May 1st of 2004.

This training program plans to involve the trainee in an interdisciplinary environment with the integration of breast cancer imaging scientists, clinicians, cognitive scientists, and educational technology professors. The project is built on the foundation of cognitive psychology, medical science, instructional technology, and information science, which embrace theories and methods in human learning, cognition, information processing, and instructional design. The research project also relates to the subject areas of CAD schemes, technology, and mammography interpretation. Therefore, the project is to meld different disciplines, use collaborative methods and find better solutions to the early detection of breast cancer.

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Introduction

This is the third year (final) year of the training program, and this is also a significant year of our training program. During this year, based on this summer training program's experience and research accomplishment, we created a new training system called "The Cognitively-based Hypermedia System for CAD-Assisted Mammography Interpretation". This training system successfully got funding support for pre-doctoral training program from Susan Komen Breast Cancer Foundation, starting from May 1st of 2004.

The training of radiological residents and medical students in mammography interpretation requires more attentions due to the seriousness and scope of breast cancer, and the difficulties and complexity in interpreting mammograms. The existing residency training programs are time-consuming, cost-ineffective and lacking in feedbacks. Moreover, they are somewhat haphazard and inconsistent in curriculum, quality of presentation, quality and quantity of practice, and instructor's time. The problems in radiology training programs suggest that more efficient, interactive, and standardized system should be established to improve radiological expertise in mammography interpretation. Therefore, we proposed an intelligent tutoring system based on cognitive science and empirical evidences.

The proposed system has been significantly better than the other existing training environments in its efficacy, interactivity and standardization. Firstly, the integration of CAD may greatly enhance performance in mammography interpretation and greatly reduce the differences in performance measures, diagnostic accuracy, error types, problem-solving strategies, and control processes among novice, intermediate and expert radiologists. Secondly, the proposed system provided very interactive interface and modules, simulating tutor-user communication. The user can have immediate idea of what he is mistaken in his visual perception and problem solving, as well as the guide to how to solve the problem in a right way. Thirdly, the repeated trials in observation, findings and diagnosis give the user a lot of practice and experience. Their knowledge and skills have been largely improved in a short period of time. Fourthly, the Web-based environment made it very convenient for the user to learn and practice. They had little limitation in time and space. Fifthly, the large database of various types of ill-defined cases made it possible for the user to compare their own diagnosis with that from CAD and radiologists. The multiple observations, comparisons and diagnosis on the same case have greatly improved the user's perception and cognitive skills. Sixthly, the research may well find out the cognitive processes and knowledge base of radiologist professionals at different expertise levels. The results have been used to construct an intelligent system for training both residents and medical students for CAD-assisted mammography interpretation. It helped standardize resident training. Finally, the increasing accuracy in mammography interpretation through using this proposed intelligent training system should greatly benefit the early detection of breast cancer.

BODY OF REPORT

Enrollment

A 12 weeks summer research training program for undergraduate students focused on understanding of digital mammography, medical imaging and breast cancers. Recruitment of program participants was recruited through poster distribution to more than 50 college campuses. Selection of program participants applications were evaluated based on

1. Letter of recommendation
2. Transcript of grades
3. 500-word essay stating why you want to attend Moffitt's Summer Training Program.

86 students applied and 23 of them completed the above 3 steps and finally only 6 of the students have been accepted for the training program each year. In order to attract and train undergraduates who have interests and potentially become excellent researcher on the breast cancer study, we designed "The Cognitively-based Hypermedia System for CAD-Assisted Mammography Interpretation" for this undergraduate training program. This proposed training program is planned for undergraduates majoring in electrical engineering, medicine science or radiology. The program was designed as following: They were guided to visit the clinical site of related devices for mammography, the biopsy process for patients with suspicious breast tumor in Moffitt cancer center. They visited the process of film-screen image converting and transmitting and display of processed medical images in the laboratory of Digital Medical Imaging Program (DMIP) in the cancer research institute. It helped trainees to set up perceptive understanding on mammography for breast cancer diagnosis. The trainees were given a series of lectures on the basic principle of mammography, medical imaging, image processing, CAD methods, generation of databases and truth files, evaluation of CAD methods by means of lecture and seminars. The purpose was to teach trainees to have basic theory and technique on the breast cancer study. Trainees practiced on development of CAD modules and completed small-scale projects related to CAD modules for breast cancer under mentors' direction. Their small-scale projects have been finally contributed to our new training system "The Cognitively-based Hypermedia System for CAD-Assisted Mammography Interpretation".

Basic Activities

The following activities were organized for the training program

(1). Orientation

1. Welcome dinner
2. Lab. Safety and Hazardous Materials management workshop
3. Tour of Library with science reference librarians
4. Introduction and Schedule of Lab. seminars, topics included

(2). Presentation Skill Training (How to design, prepare and present a research work)

1. Writing a scientific abstract
2. Poster format Presentation
3. Oral format presentation

(3). Career Opportunity Introduction *(Information on applying to graduate and medical programs)*

1. The road to Graduate School
2. Career paths after Graduate School
3. The road to Medical School
4. Research in Medical School
5. Career paths after Medical School

Training Programs

This training program plans to involve the trainee in an interdisciplinary environment with the integration of breast cancer imaging scientists, clinicians, cognitive scientists, and educational technology professors. The project is built on the foundation of cognitive psychology, medical science, instructional technology, and information science, which embrace theories and methods in human learning, cognition, information processing, and instructional design. The research project also relates to the subject areas of CAD schemes, technology, and mammography interpretation. Therefore, the project is to meld different disciplines, use collaborative methods and find better solutions to the early detection of breast cancer. The mentor, a scientist in CAD, trained the students in reviewing related literature and learning the process and methods of CAD-assisted mammography interpretation. The mentor also directed the applicant to gain an understanding of the research in the subject area through coursework, lab work, conferences, and seminars. Also the trainee have chance to co-teach in the mentor's CAD training programs. The mentor has a lot of experience in CAD-related training and teaching. At the same time the mentor provided a very good experiment and research environment for the trainee.

The training program is designed as four stages: visiting, lecturing, practicing and doing projects.

(1). Visiting

In order to get a basic understanding of mammography and the role of medical image in the breast cancer diagnosis, the trainees have been scheduled to visit the Moffitt cancer center, where they saw the clinical implementation of X-ray mammography or direct digital mammography devices to learn the process of mammography. In addition, they observed the biopsy method for the patient who is diagnosed with suspicious tumor based on their images. Noticing the pain that the patients suffer from during the biopsy, the trainees should get a deep impression about how important correct diagnosis of breast cancer based on the mammography for patients is. The undergraduates have visited the laboratory of DMIP to learn the conversion process of the film-screening image into a digital one, the generation of medical image database, the display of medical image on computer, and medical image processing. It gives trainees the understanding that CAD methods for mass and MCCs detection are helpful for breast cancer diagnosis.

(2). Lecturing

A series of lectures or seminars by mentors and other scientists in breast cancer study are planned for training undergraduates for them to obtain thorough understanding of mammography and find more interest in the study of CAD for breast cancer, which includes:

(a) General introduction of the development of mammography, emphasizing on its importance in the future and on the diagnosis of breast cancer.

(b) The features of breast tumor, the behaviors of mass and microcalcification clusters (MCCs) on X-ray images, the difference between benign and malignant tumor.

(c) The generation of image database and truth files.

(d) Basic principle of medical image, including film-screen mammography and direct digital mammography.

(e) Basic theory of image processing, including: enhancement, segmentation, feature extraction, selection and classification.

(f) Basic principle of pattern recognition and feature classification.

(g) The development of CAD methods for breast cancer detection. The emphasis should be placed on the detection of mass and MCCs with this technology.

(3). Practicing

In this training stage, undergraduates have been divided into three groups with different subjects based on their major and their interests. Students majoring in Electrical Engineering or Computer Science have mainly been divided into two groups: one group for development and optimization of CAD methods for mass/MCCs detection; another one for evaluation of CAD system with retrospective study. Trainees in medical science or radiology including some students in computer science created one group to generate image databases and truth files.

(4). Projects

Mentors design a series of small-scale projects for trainees during the three years. These projects are related to the mentors' current research topics. Students under supervision of relevant mentor can do these projects or help mentors to do something for the projects. These projects are listed as follows:

(1). To conduct empirical studies of CAD-assisted mammography interpretation, get results on the characterization of cognitive models and perception patterns in it, and find out how the integration of CAD influences the performance of radiological professionals across all levels in diagnosis and if and how CAD can help decrease errors in observation, findings and diagnosis: (a) Do coursework and participate in journal clubs and seminars of Cognitive Psychology, Perception, Medical Imaging, CAD, Information Processing, Instructional Design, and Research Methods. (b) Work on CAD and mammography in the lab under the guidance of the mentor. (c) Develop a detailed study plan for the experiments. (d) Contact the volunteers to enroll novice, intermediate and expert radiologists via e-mail, regular mail and poster. (e) Conduct research sessions, and code and analyze protocols. (f) Make discussions and draw conclusions on the findings. (g) Establish a good communication channel, including teleconference, e-mail, and face-to-face focus group/meetings, for interaction among professors and the trainee.

(2). To conduct task and content analysis through workplace studies to work out the knowledge base for the system: Conduct interviews and observations to radiologists, instructors and other professionals for task and content analysis of CAD-assisted mammography interpretation. Attend

conferences of American Association of Cancer Research (AACR), American Psychological Association (APA), American Society for Information Science and Technology (ASIST), and American Educational Research Association (AERA), to interact with renowned scientists and collect the most recent information in the related research. Help to teach summer training courses to undergraduate students who are interested in doing research in CAD and breast cancer research. Participate in seminars and journal clubs.

(3). To develop and test technology and prototype intelligent tutoring system: (a) Design the structure and modules of the system by applying empirical findings in cognitive science and empirical research. (b) Determine the approaches and technology to realize the modules. (c) Deliver, evaluate and conduct field studies to determine its effectiveness. (d) Attend conferences to collect the most recent information in the related research. (e) Teach summer training courses to undergraduate students who are interested in doing research in CAD and breast cancer research.

(4). To develop a well-organized library with existing truth files to support case-based teaching and diagnostic practice in CAD-aided mammography interpretation; integrate it into the system. Attend conferences.

(5). To develop requirements, design guidelines and recommendations for computer-based training in CAD-assisted mammography interpretation; to work out publications for the dissemination of the findings and the created system: (a) Make report of the findings and the creation of the proposed intellectual tutoring system. (b) Publicize the importance of the integration of CAD into teaching. Two papers will be submitted to related journals for publication. One will present and discuss the evidences of how the integration of CAD influences the performance of radiology professionals across all levels, including the diagnostic accuracy, error types, problem-solving strategies and control processes, and how the results can be used to design a Web-based hypermedia system. The other will be on the field tests of teaching rounds with the new system and some guidelines and principles for the future computer-based training system design.

(6). Accurate histo-morphological distinction of breast cancer cells and distinction of specific subtypes of cancer cells are critical for optimum patient care and often can present a diagnostic challenge to a pathologist. This project proposes a novel computer-aided pathological diagnosis (CAPD) system for classifying the histo-differences between normal cells, cancer cells and subtypes of cancer cells, which is an innovative and efficient way for breast cancer early diagnosis. Molecular/Cellular-based approach to early detection is a revolution in diagnosis. This project designs a new CAPD system for detection and diagnosis of breast cancer with cellular images. It includes the following novel modules: (1) a novel adaptive fragmentary window filtering (AFWF) algorithm for circularity enhancement which is an important feature to identify normal and cancer cells, (2) modification of tree-structured nonlinear filtering (TSF), directional wavelet transform (DWT), tree-structured wavelet transform (TSWT), segmentation, feature extraction/selection, and classification modules. (3) Declustering for isolation of cell and nuclear. The CAPD method will be as a leading technology that can be exploited to address the current issues associated with using cellular image for early stage detection of breast cancer.

(7). Investigate the development of image preprocessing modules: It is the first and important stage in image processing. Several methods for this module have been developed with different algorithms, some of them the student has studied. We are trying to develop new adaptive image preprocessing modules. The trainees took part in parts of this research project to learn about the development of contemporary CAD preprocessing methods. They performed comparison test

among current developed methods through computer programming for different image databases. After finishing the work, the trainees wrote a report about the performance comparison of the CAD module with different image databases. During training, the trainees were encouraged to propose their own methods for this module and to do related computer programming.

(8). Generation of image databases and truth files: databases of film-screening mammography have been configured and are being expanded, the databases for direct digital mammography have been developed. The trainees generated databases for different kinds of images under the direction of mentors and research assistants. They learnt to construct the truth files for image databases. The student was required to submit reports about the constructed image database and related truth files.

(9). Development of Adaptive CAD module for false positive (FP) reduction: Sensitivity and false positive rate are two factors that greatly affect the clinical trial of CAD modules. For a long time, these two performance factors of CAD system were not suitable for the clinical use. Efforts are placed on searching an ideal method that can obtain high sensitivity and keep low false positive rate. The trainees worked on the investigation of the current literature. In our medical imaging Lab., a new kind of adaptive CAD system for false positive reduction has been developed. The trainees assisted the mentor to test the performance of developed CAD methods. The students submitted a report on the performance of new module for FP reduction.

(10). Evaluation of CAD system for breast cancer study: so many CAD systems for mass and MCCs detection have been developed, which need retrospective study and clinical analysis. It is suitable to do this evaluation study. Following the guidance of mentors, the trainee performed retrospective analysis on current CAD modules using the data sets developed through the Department of Defense Breast Cancer Research Program (BCRP) grant to the University of South Florida (USF) (http://marathon.csee.usf.edu/Mammography/ Database.html) for film screening mammography or the databases developed by themselves for digital mammography. Being familiar with evaluation method for retrospective study, the students presented evaluation reports for different CAD systems.

(11). The research project involves three parts. ***The first part*** is for initial optimization of each module performed using standard signal processing criteria, analysis of simulated images and comparison of segmented images of mass area to ground truth files. The adaptive techniques are used to improve image preprocessing CAD modules. ***The second part*** is focused on a novel, fully automatic and highly efficient method for CAD system full optimization based on the clinical objective. The objective function is built from a set of 2000 case mammograms that contain: 200 mammograms with no lesion (normals), 1800 mammograms with masses of irregular, circumscribed, microlobulated, obscured, ill-defined and spiculated as defined in BI-RADS. ***In the third part,*** is to design a statistic test to validate the optimized algorithm model. This statistical method is the Hypothesis Testing with the Null Hypothesis (NH) of that the two parameter settings of the CAD system have the same performance. The students submitted a report on the above study.

Assessment of the Program and Evaluation of the Students

Summarizing the previous research achievements from these projects, we proposed a new project focused on improving CAD–assisted mammography system. The students were from different fields, College of Medicine, Computer Science, Instructional Technology, and Electrical

Engineering. Their career goals are to be an independent investigator in breast cancer related field and to investigate various possibilities of improving the perception, prevention, early detection, and diagnosis of breast cancer with mammography and computer-assisted diagnosis (CAD) through the methods integrating cognitive psychology models, educational technology, and information science. Their short-term goals are to create a novel system for CAD-assisted mammography interpretation, standardize radiologist residency training programs, and improve other programs for training technologists and medical students, making them more interactive, accessible, adaptable, and effective. The increasing accuracy in mammography interpretation should greatly benefit the early detection of breast cancer.

To achieve these goals, we proposed a highly innovative training program for excellence in breast cancer related research. The proposed training will largely promote their future in breast cancer research and prepare them to become an independent researcher in this field. Through the proposed training, the students have opportunities to interact with leading imaging and CAD scientists, radiologists, psychologists, cancer education professors, statisticians, and other experts in the interdisciplinary environment of Moffitt Cancer Center and Research Institute. This immersion should cultivate both intuition and deep thinking in them about their careers in breast cancer research and education. This immersion and the other academic activities should also largely improve their competencies, knowledge, and skills in breast cancer education and research. In their future research, they examined cognitive factors underlying medical expertise in CAD-assisted and non-CAD-assisted mammography interpretation. The patterns of normality, abnormality, and errors can also be examined by analyzing the perception, problem solving strategies, knowledge and control processes underlying radiologists' performance. The emphasis of the students' research is directed towards constructing an empirical-driven and cognitively-based hypermedia system for training radiology residents, medical students, and technologists in CAD-assisted mammography interpretation. A system prototype has been constructed and tested. The results of the investigation has a wide range of applicability that helps to address existing problems and issues in resident training and medical education. These studies in cognitive models and expert knowledge and the established system in training have laid a good foundation for the following-up research and practice in the future. After the completion of this project, the students should be an more independent researcher in breast cancer and they should demonstrate their research abilities and achievements in this interdisciplinary area, and should have a dedication to the excellence and innovation in breast cancer research, education, and training.

The purpose of this project is for the improvement of radiologist diagnostic performance in mammography interpretation with CAD as the second reader. The research project is proposed to have a better understanding of the expert knowledge model of mammography interpretation, which may lead to a better training system. Also the resulting model, other methods and tool may improve the effectiveness of training system in mammography interpretation with the assistance of computer-aided diagnosis (CAD). The results can be applied in the development and improvement of training modules for training programs.

The objective of the project is to identify the problem-solving model and cognitive components underlying non-CAD and CAD-assisted mammography interpretation expertise. It also intends to find out how the integration of CAD influences the performance of radiological professionals across all levels in diagnosis and if and how CAD can help decrease errors in observation, findings and diagnosis. It also designs and creates a web-based hypermedia prototype tutoring system on the basis of the identified cognitive model, factors, and empirical evidences. The system is to be accessed by the trainees in their time slot. Also the program provided enough communication between the computer tutor and the trainee so that the trainee

can be corrected in his perception and performance on time and get to know the delicate differences in perception and problem solving in different case situation. The study also determines an efficient way to integrate CAD in the system and investigate the principles and methods for a better system. It should build up the learners' confidence, skills and experience in extending their perception with CAD. The following specific tasks have been carried out: (1) to construct a perception and problem-solving model of CAD-assisted mammography interpretation, (2) to analyze and identify if and how CAD greatly reduces the novice-expert differences in radiological observation, findings, diagnosis, diagnostic accuracy, reasoning strategies, error types, problem-solving operators and control processes, (3) to design an intelligent tutoring system for training both radiologist residents and medical students in CAD-assisted mammography interpretation, using the results of expert knowledge study, (4) to conduct workplace studies through interviews and observations for task and content analysis, (5) to develop a prototype Web-based training environment embedded in cognitive tools with hypermedia authoring software and conduct field studies to determine its effectiveness, (6) to construct a well-organized library with existing truth files that support case-based teaching and diagnostic practice in CAD-aided mammography interpretation. A library of cases has been constructed and extended using specific classification and subject headings, and (7) to apply methodology of cognitive science and results in empirical research to develop requirements, design guidelines and recommendations for computer-based training in CAD-assisted mammography interpretation.

The assessment of the program is based on weather the smooth implementation of the whole program structure, starting from recruitment of the participants, until to the end of the final project report. The participation of the mentors/scientists included, Wei Qian, Ph.D. (Associate Professor), John Heine, Ph.D. (Assistant Professor), Robert Clark M.D. (Professor), Xuejun Sun, Ph.D. (Research Associate). All participant students are good at following rules. They worked hard, but, they are "too young" for doing advanced projects. We don't want to design small projects that are only for their practice and not useful for our research goal. All the projects assigned to them are parts of our works served for our main goals. In consequence, these training students can not independently handle these projects by themselves. They are good helpers, such as database organization, truth files, running programs, turning different parameters for optimization of the algorithms. The following **Key Research Accomplishments** are well done with these students' help.

Key Research Accomplishments

(1). Well done: to conduct empirical studies of CAD-assisted mammography interpretation, get results on the characterization of cognitive models and perception patterns in it, and find out how the integration of CAD influences the performance of radiological professionals across all levels in diagnosis and if and how CAD can help decrease errors in observation, findings and diagnosis: (a) Do coursework and participate in journal clubs and seminars of Cognitive Psychology, Perception, Medical Imaging, CAD, Information Processing, Instructional Design, and Research Methods. (b) Work on CAD and mammography in the lab under the guidance of the mentor. (c) Develop a detailed study plan for the experiments. (d) Contact the volunteers to enroll novice, intermediate and expert radiologists via e-mail, regular mail and poster. (e) Conduct research sessions, and code and analyze protocols. (f) Make discussions and draw conclusions on the findings. (g) Establish a good communication channel, including teleconference, e-mail, and face-to-face focus group/meetings, for interaction among professors and the trainee.

(2). Well done: to conduct task and content analysis through workplace studies to work out the knowledge base for the system: Conduct interviews and observations to radiologists, instructors and other professionals for task and content analysis of CAD-assisted mammography interpretation. Attend conferences of American Association of Cancer Research (AACR), American Psychological Association (APA), American Society for Information Science and Technology (ASIST), and American Educational Research Association (AERA), to interact with renowned scientists and collect the most recent information in the related research. Help to teach summer training courses to undergraduate students who are interested in doing research in CAD and breast cancer research. Participate in seminars and journal clubs.

(3). Well done: to develop and test technology and prototype intelligent tutoring system: (a) Design the structure and modules of the system by applying empirical findings in cognitive science and empirical research. (b) Determine the approaches and technology to realize the modules. (c) Deliver, evaluate and conduct field studies to determine its effectiveness. (d) Attend conferences to collect the most recent information in the related research. (e) Help to teach summer training courses to undergraduate students who are interested in doing research in CAD and breast cancer research.

(4). Well done: to develop a well-organized library with existing truth files to support case-based teaching and diagnostic practice in CAD-aided mammography interpretation; integrate it into the system. Attend conferences.

(5). Well done: to develop requirements, design guidelines and recommendations for computer-based training in CAD-assisted mammography interpretation; to work out publications for the dissemination of the findings and the created system: (a) Make report of the findings and the creation of the proposed intellectual tutoring system. (b) Publicize the importance of the integration of CAD into teaching. Two papers will be submitted to related journals for publication. One will present and discuss the evidences of how the integration of CAD influences the performance of radiology professionals across all levels, including the diagnostic accuracy, error types, problem-solving strategies and control processes, and how the results can be used to design a Web-based hypermedia system. The other will be on the field tests of teaching rounds with the new system and some guidelines and principles for the future computer-based training system design.

(6). Well done the basic research work on the design of a new CAPD system for detection and diagnosis of breast cancer with cellular images. It includes the following novel modules: (1) a novel adaptive fragmentary window filtering (AFWF) algorithm for circularity enhancement which is an important feature to identify normal and cancer cells, (2) modification of tree-structured nonlinear filtering (TSF), directional wavelet transform (DWT), tree-structured wavelet transform (TSWT), segmentation, feature extraction/selection, and classification modules. (3) Declustering for isolation of cell and nuclear.

(7). Well done the project of "development and optimization of CAD modules". We have developed lots of CAD modules. At first, the trainees were given the detailed process for CAD module development, then they were given a designated projects that is related to mentors' current research work, the trainees were asked to complete the project under the mentors' direction. It helped them get thorough understanding of development of CAD modules. Moreover, what they are assigned to do is closely related to the modern development of CAD modules for breast cancer detection. This helped them pursue careers in breast cancer.

(8). Well done the generation of medical image databases and truth files: The trainees were directed by mentor to collect different images and related information, convert film-screening images to digital format with digitizer, and construct medical image databases for both film-screening and direct digital mammography. The students studied the feature of mass and MCCs under the direction of mentors.

(9). Well done the evaluation of CAD modules: so many CAD systems for mass and MCCs detection have been developed. They need retrospective analysis with testing databases, which is a suitable study for the trainees.

Reportable Outcome

Proposal Created:

1. "The Cognitively-based Hypermedia System for CAD-Assisted Mammography Interpretation" Funded in May of 2004 from Susan Komen Breast Cancer Foundation

2. "Computer aided Molecular Biology Research and Analysis Model Construction for Breast Cancer" submitted to DoD as a pre-doctoral traineeship award in June of 2004

1. "Computerized Analysis of Cellular Features for Breast Cancer Diagnosis" submitted to DoD as a concept award in January of 2004

2. "Multimedia Telediagnosis Via Internet and Wireless Communication Networks for Breast Cancer" submitted to DoD as an idea award in June of 2004

3. "Computer-aided Pathological Diagnosis for Breast Cancer early detection" submitted to DoD as an idea award in June of 2004

Conference Abstract:

X. J. Sun, W. Qian, "Computer-aided detection of lung nodule on helical CT", 8th World Multiconferenc Systemics, Cybernetics and Informatics (SCI 2004), Orlando, USA, 2004.

Hongshun Su, Wei Qian, Sun XJ and Sankar R "A NEW KNOWLEDGE-BASED LUNG NODULE DETECTION SYSTEM" Proceeding of ICASSP 2004 in Montreal, Canada

Wei Qian, Li K, Sun XJ, Song DS and Sharma A, "Computer-aided Pathological Diagnosis for Lung Cancer Cell Detection" Proceedings of 9th IASTED International Conference on Signal and Image Processing, August 13-15, 2003, Honolulu, Hawaii, USA

Wei Qian, Zhang Y, Sun XJ, Song DS and Sankar R, "A New Computer-aided Diagnosis System for Prostate Cancer Detection on TRUS imaging" Proceedings of 9th IASTED International Conference on Signal and Image Processing, August 13-15, 2003, Honolulu, Hawaii, USA

Yue Shen, Ravi Sankar, Wei Qian, Xuejun Sun, Dansheng Song, " Fuzzy Image Segmentation For Lung Nodule Detection" Proceedings of IEEE, 2003 International Conference on Acoustics, Speech, and Signal Processing (ICASSP 03), 6-10 April 2003 in Hong Kong,

Wei Qian, Kun Li K., Jin Yu and Yao Yudong, "Feature Extraction of Cancer Cells Using Wavelet Transform" 7th World Multi-Conference on SYSTEMICS, CYBERNETICS AND INFORMATICS (SCI 2003), Orlando, FL, July 27-30, 2003

Wei Qian, Xuejun Sun and Robert Clark, " Research Project Design for Summer Training Program on CAD System" Technical Program for the U.S. Army Medical Research and Materiel Command's (USAMRMC) Era of Hope 2002 DoD Breast Cancer Research Program Meeting, Orlando, Florida, September 25-28, 2002.

Conclusions

The new project studied in this year, i.e. "The Cognitively-based Hypermedia System for CAD-Assisted Mammography Interpretation", has been successfully done, which includes: (1) To construct a problem-solving model of CAD-assisted mammography interpretation, (2) to analyze and identify if and how CAD greatly reduces the novice-expert differences in radiological observation, findings, diagnosis, diagnostic accuracy, reasoning strategies, error types, problem-solving operators and control processes, (3) to design an intelligent tutoring system for training both radiologist residents and medical students in CAD-assisted mammography interpretation, using the results of expert knowledge study, content and task analysis and (4) to develop a prototype web-based computer-assisted training environment embedded in cognitive tools with hypermedia authoring software.

The long-term aim of this program is to encourage undergraduates pursuing the careers on breast cancer study, and to attract their interests on the development of CAD methods for diagnosis of breast cancer. The main objectives of this training program are:

1. Learning the basic principles of mammography and image processing, mastering basic methodologies for imaging breast cancer detection.
2. Stimulating trainees' interests on breast cancer study, encouraging students to pursue their academic career on the breast cancer study.

The training program is successful. The trained undergraduates are planned to be tracked their future careers to see the achievement of training program.